

Kinematics Concepts

- Position
 - Time
 - Magnitude
 - Speed
 - Vector
- Velocity
 - Acceleration
 - Displacement
 - Distance

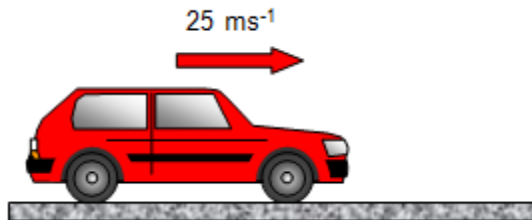
Vectors and Scalars

Vector - quantity with both magnitude (size) and direction

Scalar - quantity with magnitude only

Vectors:

- Displacement
- Velocity
- Acceleration



Scalars:

- Distance
- Speed
- Time
- Mass

Mass vs. Weight

Mass

- Scalar (no direction)
- Measures the amount of matter in an object

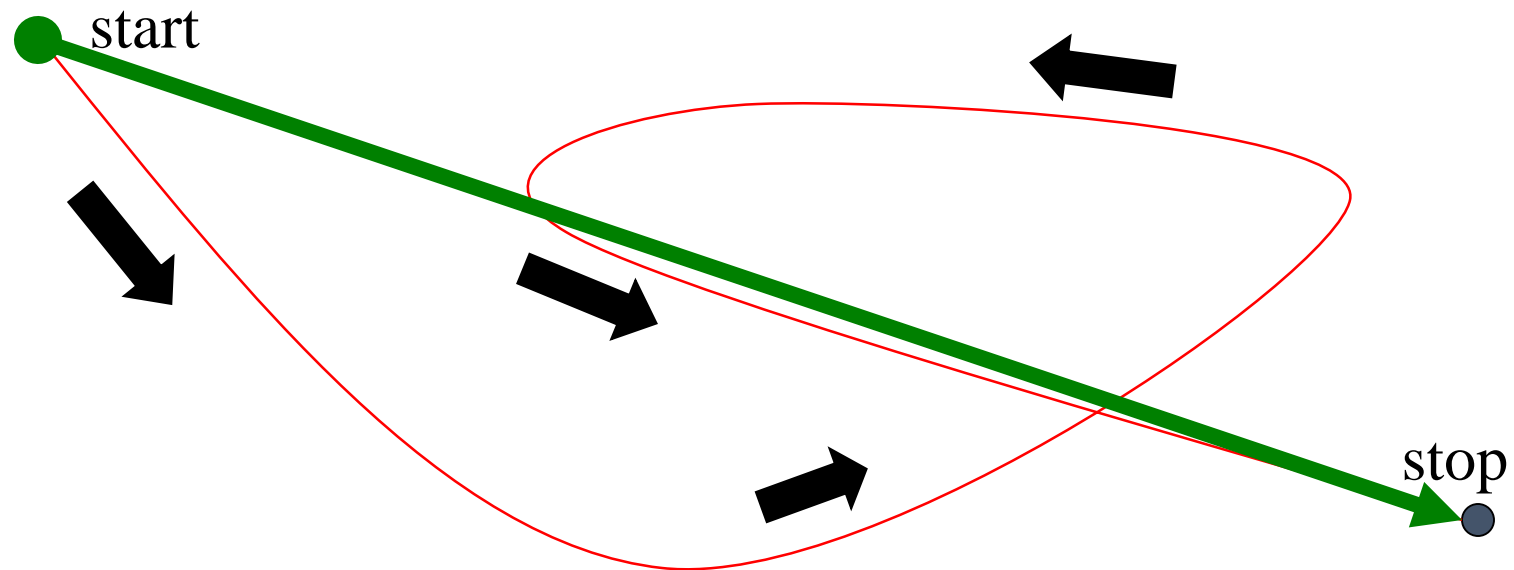
Weight

- Vector (points toward center of Earth)
- Force of gravity on an object

On the moon, your mass would be the same, but the magnitude of your weight would be less.

Distance vs. Displacement

- You drive the path, and your odometer goes up by 8 miles (your distance).
- Your displacement is the shorter directed distance from start to stop (green arrow).



Speed, Velocity, & Acceleration

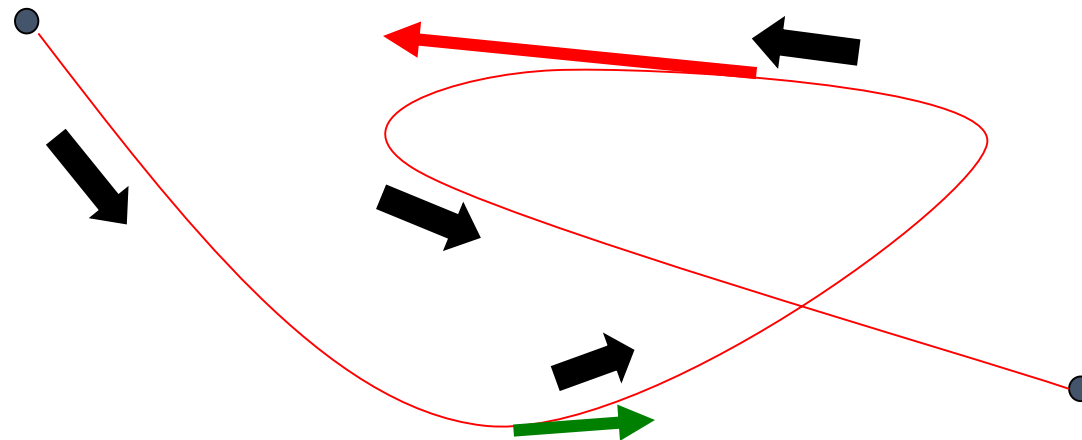
- Speed (v) – how fast you go
- Velocity (\mathbf{v}) – how fast and which way; the rate at which position changes
- Average speed (\bar{v}) – distance/time
- Acceleration (\mathbf{a}) – how fast you speed up, slow down, or change direction; the rate at which velocity changes

Speed vs. Velocity

- Speed is a scalar (how fast something is moving regardless of its direction).
Ex: $v = 20 \text{ mph}$
- Speed is the magnitude of velocity.
- Velocity is a combination of speed and direction. Ex:
 $\mathbf{v} = 20 \text{ mph at } 15^\circ \text{ south of west}$
- The symbol for speed is v .
- The symbol for velocity is type written in bold: \mathbf{v} or hand written with an arrow: \vec{v}

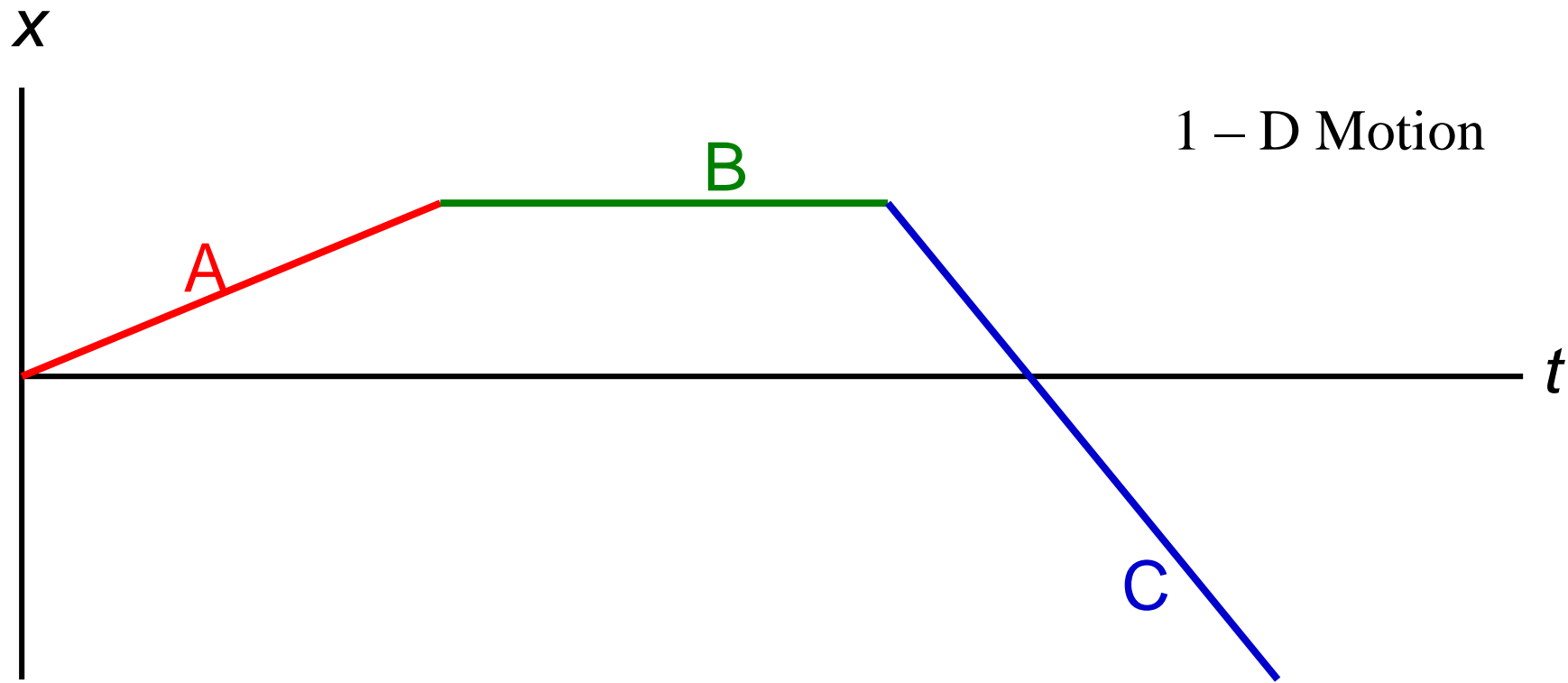
Speed vs. Velocity

- During your 8 mi. trip, which took 15 min., your speedometer displays your instantaneous speed, which varies throughout the trip.
- Your average speed is 32 mi/hr.
- Your average velocity is 32 mi/hr in a SE direction.
- At any point in time, your velocity vector points tangent to your path.
- The faster you go, the longer your velocity vector.



Graphing Position vs. Time

- 1D motion
 - Motion in a line and/or curve
 - Stepping to the left or right while moving forward is not included
 - Jumping up and down not included
- Can graph velocity and acceleration given position vs time

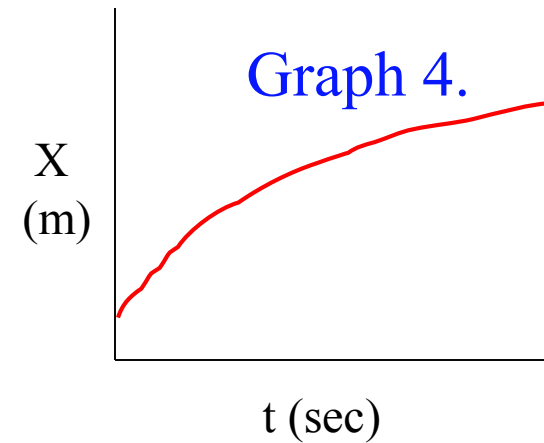
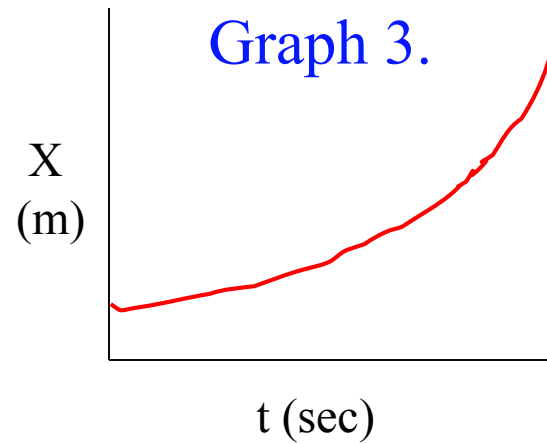
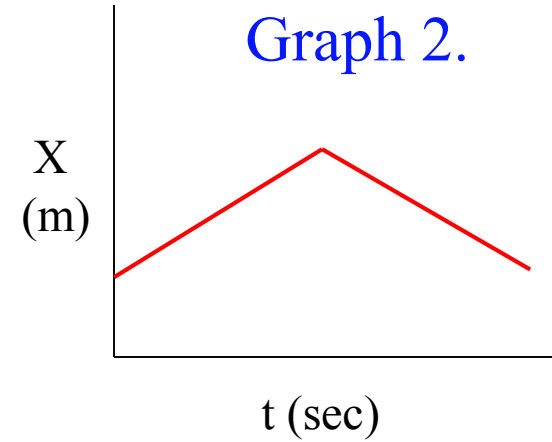
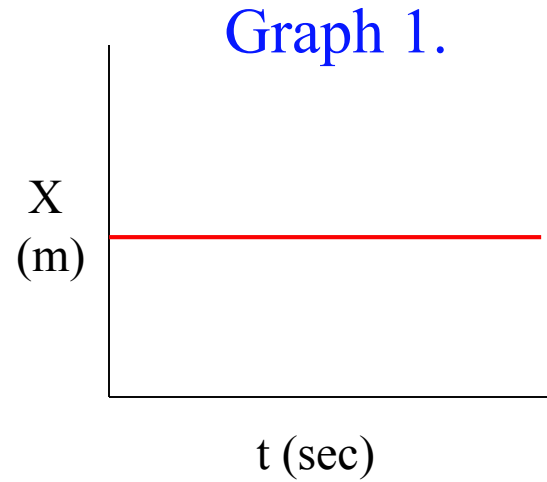


A ... Starts at home (origin) and goes forward slowly

B ... Not moving (position remains constant as time progresses)

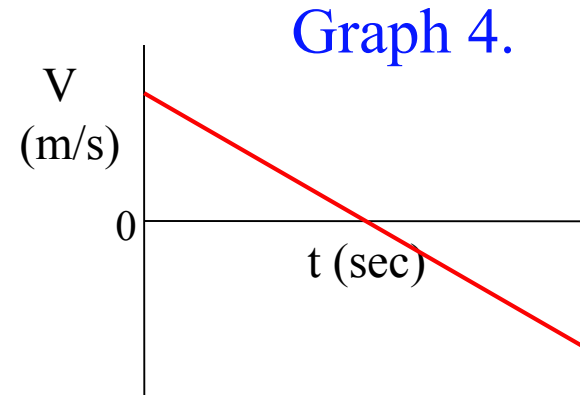
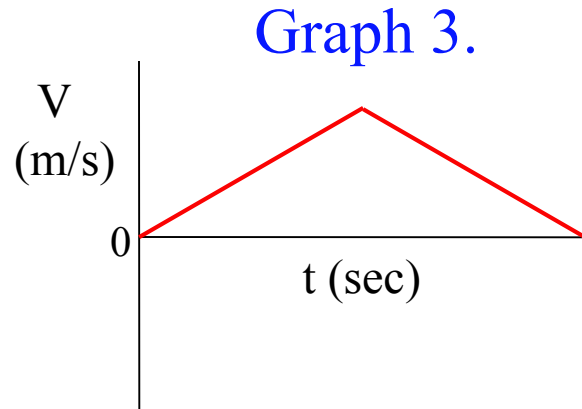
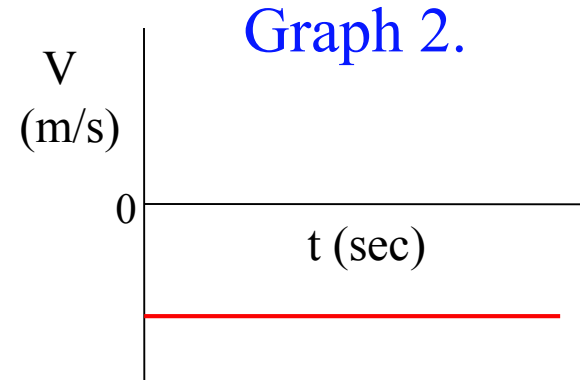
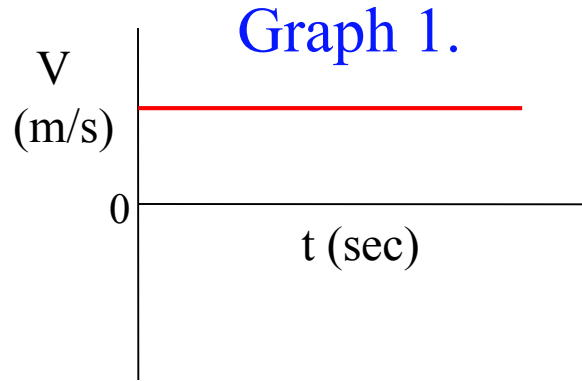
C ... Turns around and goes in the other direction quickly, passing up home

How Can You Create the Following Position Graphs?



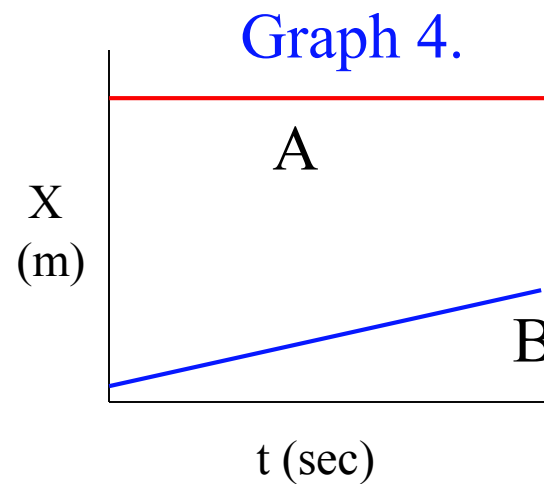
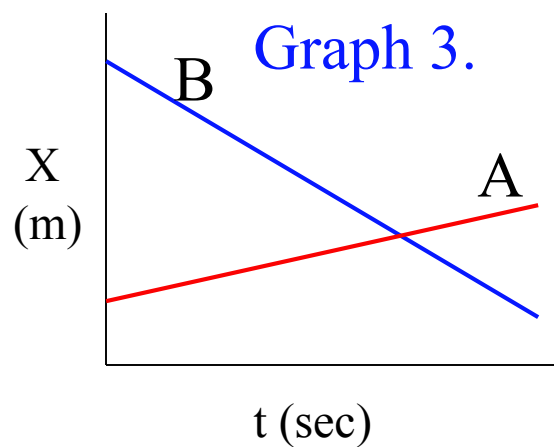
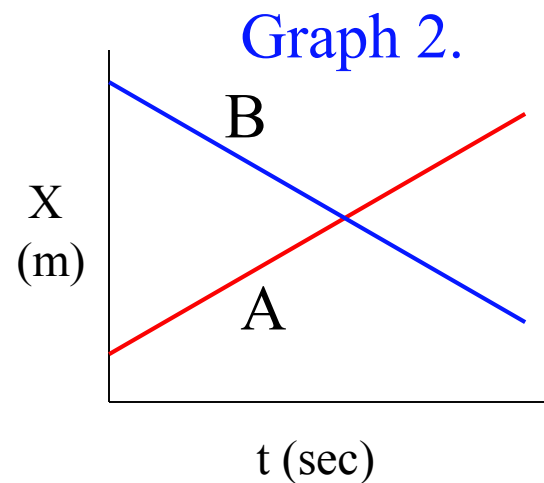
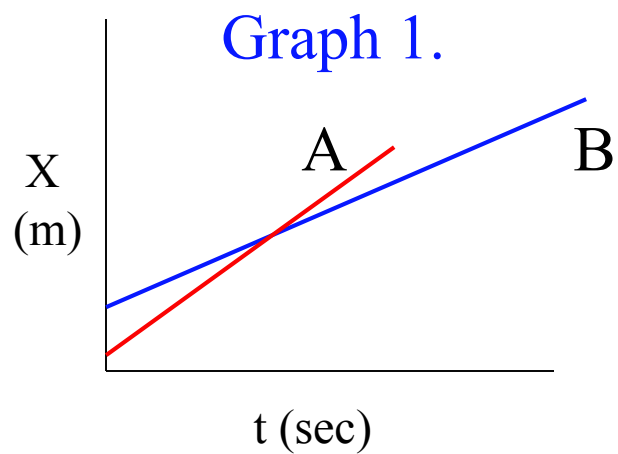
- A. Speed Up
- B. Turn Around
- C. Slow Down
- D. Stand Still

How Can You Create the Following Velocity Graphs?



- A. Speed Up, then Slow Down
- B. Turn Around
- C. Walk Away
- D. Stand Still
- E. Walk Toward

Which Object is Moving Faster (Greatest Speed)?



- A. Line A B. Line B C. Tie D. Can't Tell